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ANNEX V

TO THE PROTOCOL ON COOPERATION IN THE FIELD OF
FOSSIL ENERGY RESEARCH AND DEVELOPMENT
BETWEEN
THE DEPARTMENT OF ENERGY OF THE UNITED STATES OF AMERICA (USDOE)
AND
THE MINISTRY OF COAL INDUSTRY
OF THE PEOPLE'S REPUBLIC OF CHINA (CMCI)
IN THE AREA OF
ATMOSPHERIC FLUIDIZED BED (AFB) COMBUSTION INFORMATION EXCHANGE

WHEREAS, the USDOE and the CMCI signed a Protocol on Cooperation in the Field of Fossil Energy Research and Development on April 16, 1985, in Washington, D.C. (hereinafter referred to as the Protocol); and

PURSUANT to Article 5 of the Protocol, both Parties wish to enter into the following agreement as "Annex V" to the Protocol to conduct technical exchange and research cooperation in the area of Atmospheric Fluidized Bed (AFB) Combustion Information Exchange based on the principle of equality, reciprocity and mutual benefit.

ARTICLE I - OBJECTIVES

1. The U.S. Department of Energy (USDOE) and the People's Republic of China Ministry of Coal Industry (CMCI) wish to initiate cooperative research and development activities in the field of Atmospheric Fluidized Bed (AFB) Combustion Information Exchange, with the aim of achieving mutual benefits from such activities.
2. This activity under the U.S./PRC Protocol will establish joint information exchange in the field of AFB Combustion technology, with emphasis on expanding and accelerating the AFB data base, and developing advanced technology for economically viable generating systems.

ARTICLE II - SCOPE OF WORK

The U.S. AFB Program seeks to develop a technology data base so that the industrial, commercial, and residential sectors can operate coal-fired AFB systems capable of economically generating process steam, indirect and direct heat, and on-site electric power as a means of displacing oil and gas.

First generation AFB technology is considered commercial; 19 U.S. boiler manufacturers are offering commercial units, and approximately 105 units are either in operation or under construction. However, many of these first units are products of empirical design and are marginal in economics, performance, and reliability. To resolve the remaining

technical issues, broaden the market sector, and expand the use of AFB technology, the Department of Energy (DOE) is pursuing advanced concepts and special applications of second generation AFB technology development.

The objective of the U.S. AFB Program is to develop this second generation technology by 1990 so that the private sector can demonstrate and commercialize coal-fired AFB systems for the industrial, commercial, and residential sectors. These systems should be capable of economically generating process steam, meeting direct and indirect heating requirements, and generating electric power on-site, as a means of displacing oil and gas.

The People's Republic of China (PRC) and the U.S. desire to expand and accelerate the AFB technology data base for utility, industrial, commercial and residential boilers, furnaces, and heaters. This will be accomplished by means of cooperation and, where possible, coordination in the planning and execution of national AFB programs; wherein, program activities are mutually supportive and complementary, while meeting national needs and requirements.

Approach

The primary function of this agreement is to provide for data and information exchange. Participants agree to contribute data/information from existing national projects in the agreed technology areas. Each participant shall have the sole responsibility for planning, implementation, supervision, and financing of its national project(s).

The cooperative program shall consist of the following specific tasks.

Task 1. Information Exchange

Participants agree to cooperate through periodic exchanges of information on the activities of their national AFB research and development (R&D) program. As available, participants agree to exchange information on industrial AFB activities.

The exchange shall include sufficient detail on the technical scope, timing and planned funding levels of each contributing project to permit adjustments in national program direction or scope, if desirable. Information exchanged shall include technical data base test results, economic and technical assessments, and environmental issues.

A joint meeting/workshop shall be held annually to review progress/problems on all projects included in the agreed upon data exchange. The meeting shall be held at a mutually agreed upon time and place, with the sites being alternated between the PRC and the U.S.

Task 2. Fluidized Bed Combustion (FBC) Materials R&D

Because of the large number of operational FBC units in the PRC and the period of time that these units have been operational, it is logical to

assume that an extensive data base exists, which includes data on the effect of tube geometry, properties of different materials and the effect of extended surfaces as they relate to the wear of tubes. This data base could form an important amalgamation of information for interpretation and analysis that could be accomplished using U.S. computer and computer modeling capabilities.

The PRC will provide the data base from their considerable background of operational hours, and the U.S. will provide modeling capabilities and the know-how toward attempting to understand the phenomena of metal wastage of in-bed surfaces (that is, tube-bundle erosion). Together, the PRC and the U.S. will support the evaluation of the data and share in the results..

Task 3. Fluidized Bed Tests

The U.S. and the PRC will develop a mutually agreeable test plan in which the U.S. would provide instrumentation--on a loan basis--for several PRC fluid bed units. The units would be operated with PRC-supplied funds. Together, the two countries will evaluate the data. The instrumentation will be returned to the U.S. upon completion of the agreed upon tests.

ARTICLE III - MANAGEMENT AND OPERATIONS

1. Project Managers

Each Party shall designate a project manager for this Annex VI. The project managers shall plan the technical approach for accomplishing the two objectives, be responsible for programmatic aspects and schedule of this Annex, and schedule, coordinate, and co-chair joint meetings.

2. Advisors

Representatives from organizations within each Party may be invited to attend joint meetings and to serve as advisors to help plan and evaluate cooperative AFB research and development in the U.S. and in the PRC. Other organizations may be invited to participate in the future if approved jointly by the project managers.

3. Visits

There may be a short term exchange of scientists and engineers in the institutions or research laboratories of either Party. The logistics, including the number of scientists and engineers to be exchanged, shall be agreed upon by the project managers.

4. Joint Seminars

Each Party may conduct joint seminars on selected topics as determined by the project managers.

5. Reports

- A. The Parties shall prepare semi-annual technical progress reports of all activities in their respective areas of responsibility for distribution to their counterpart.
- B. The Parties shall jointly prepare an annual report describing the work performed and detailing results achieved. Each Party shall have the right to disseminate the annual report without consulting the other Party.

ARTICLE IV - FINANCE

1. All cooperative activities under this Annex shall be subject to the availability of funds and personnel and to the laws and regulations of the respective countries.
2. Unless otherwise mutually agreed in writing, each Party shall bear all costs of its activities.

ARTICLE V - INFORMATION

1. All information provided to and arising under this Annex and all inventions or discoveries made or conceived under this Annex, and other international property rights issues will be treated in accordance with Annex I to the Fossil Energy Protocol.

ARTICLE VI - ENTRY INTO FORCE AND TERMINATION

1. This Annex shall enter into force upon signature by the Parties and remain in force for five (5) years or until the termination of the Protocol. This Annex may be amended or extended by mutual written agreement of the Parties.
2. At the discretion of either Party, this Annex may be terminated upon six (6) months advance notice in writing to the other Party. Any damages related to such termination shall be treated in accordance with the terms of the Fossil Energy Protocol.

Done at Beijing, on the October 13, 1987
in duplicate in the English and Chinese languages, each equally authentic.

Donald H. Bauer
For the Department of Energy of the
United States of America

[Signature]
For the Ministry of Coal Industry
of the People's Republic of China